Nov. 18, 1924. 1,516,108

F. LJUNGSTRÖM ET AL

REGENERATIVE AIR PREHEATER

Filed Aug. 21, 1922 3 Sheets-Sheet 1

Fig. 1.

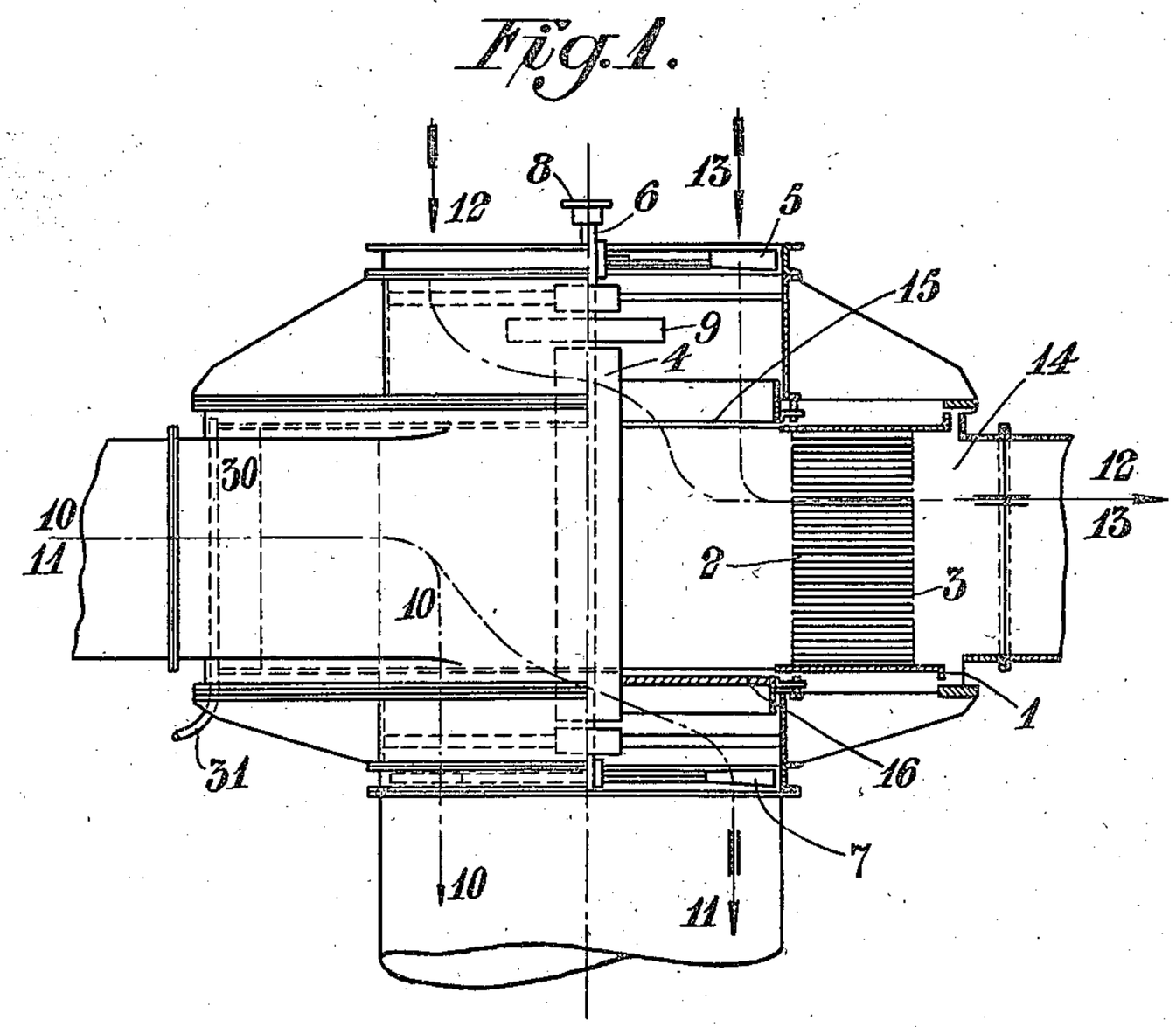
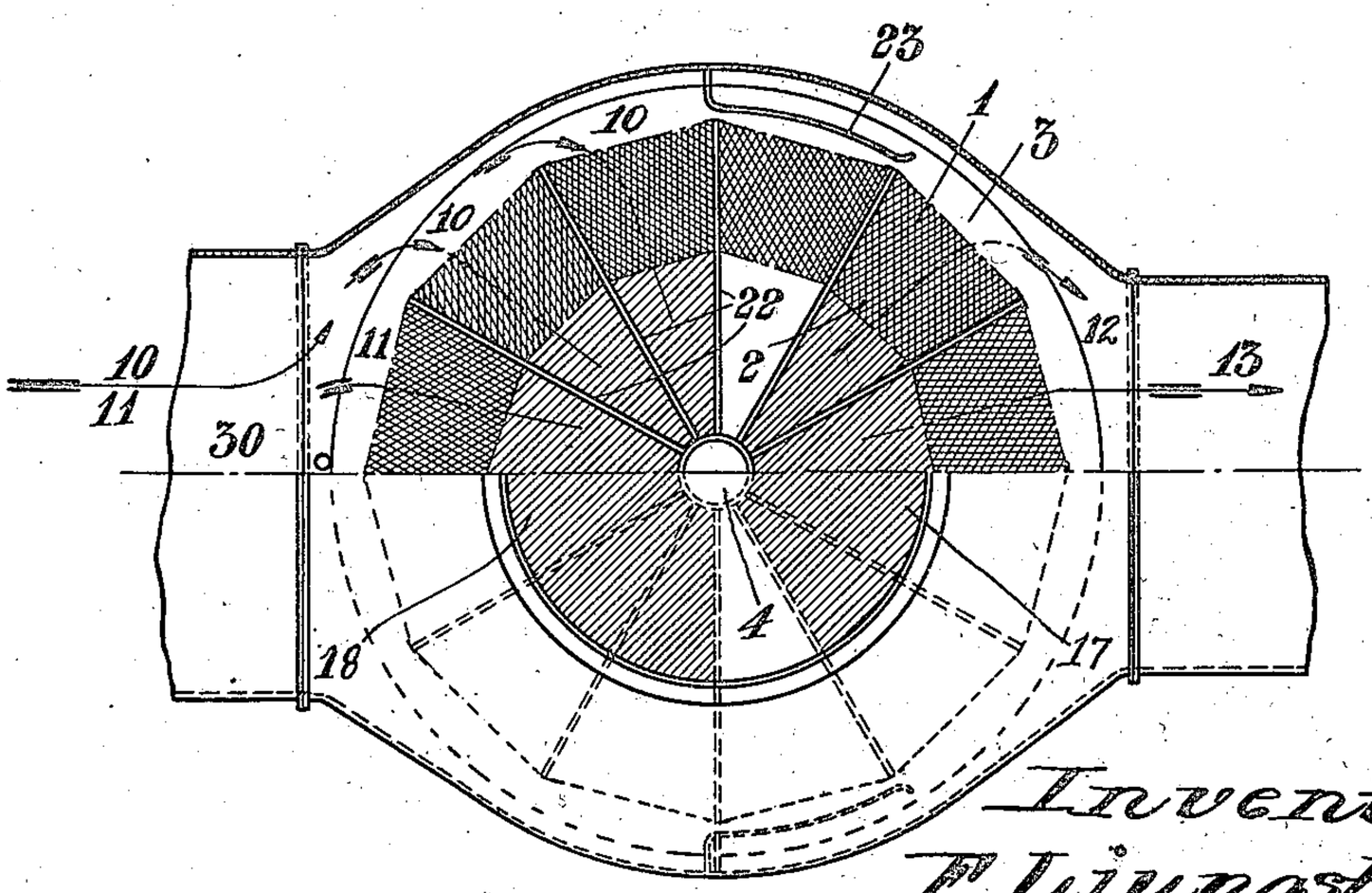


Fig. 2.



Inventors
F. Ljungström
N. F. F. Andersson
By Marks Clark
Attys.

Nov. 18, 1924. 1,516,108

F. LJUNGSTRÖM ET AL

REGENERATIVE AIR PREHEATER

Filed Aug. 21, 1922 3 Sheets-Sheet 2

Fig. 3.

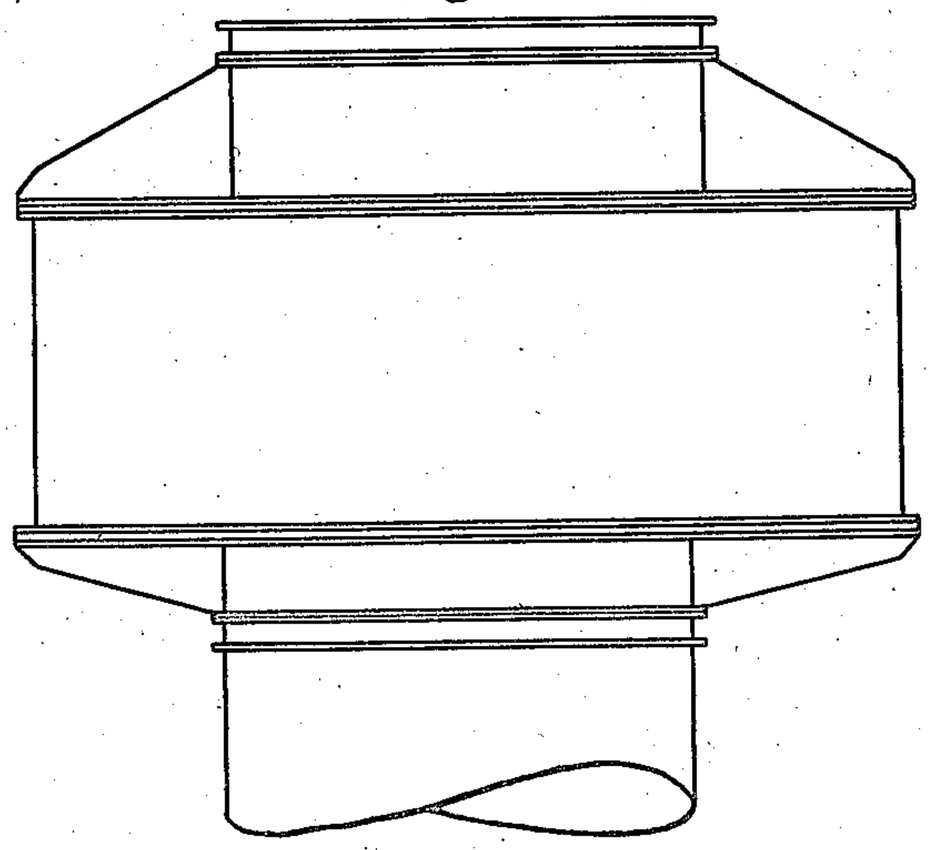
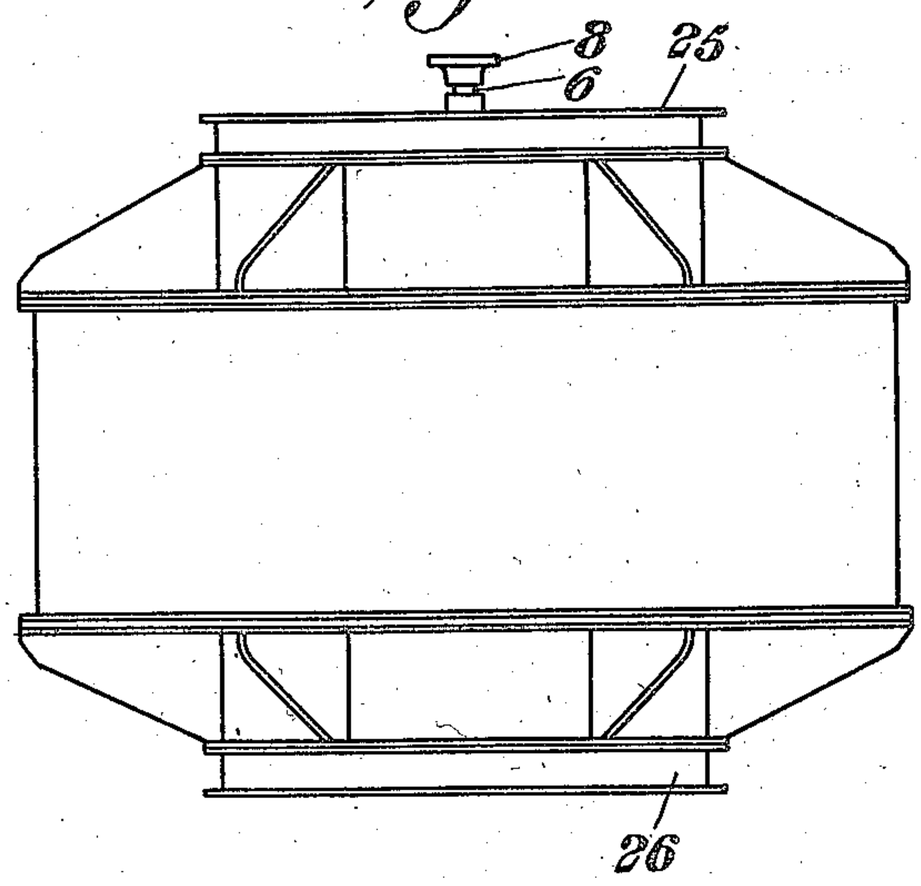


Fig. 6.



Inventors
F. Ljungström,
N.F.F. Andersson
By Marks & Clerk Attys.

Nov. 18, 1924. 1,516,108

F. LJUNGSTRÖM ET AL

REGENERATIVE AIR PREHEATER

Filed Aug. 21, 1922 3 Sheets-Sheet 3

Fig. 4.

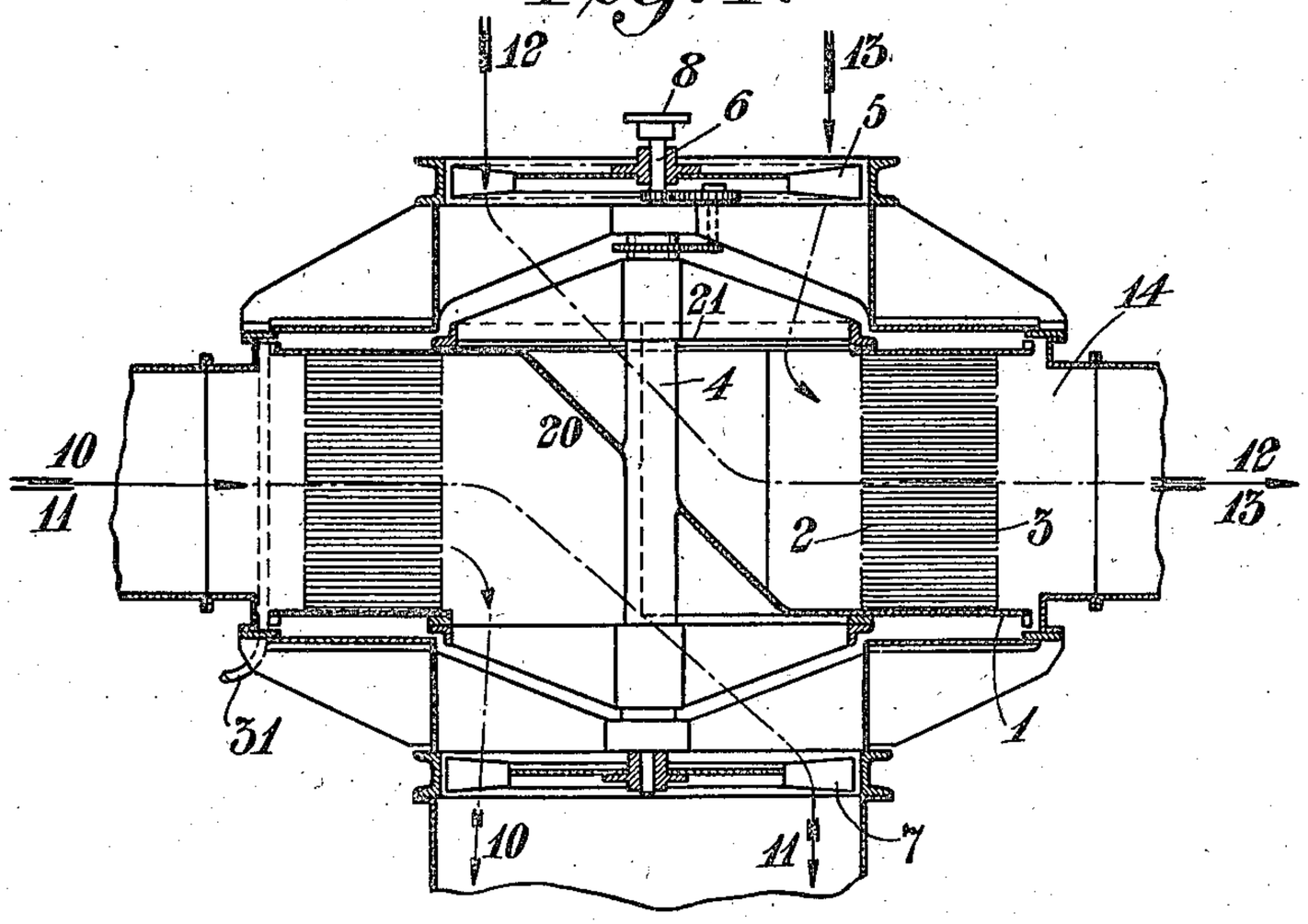
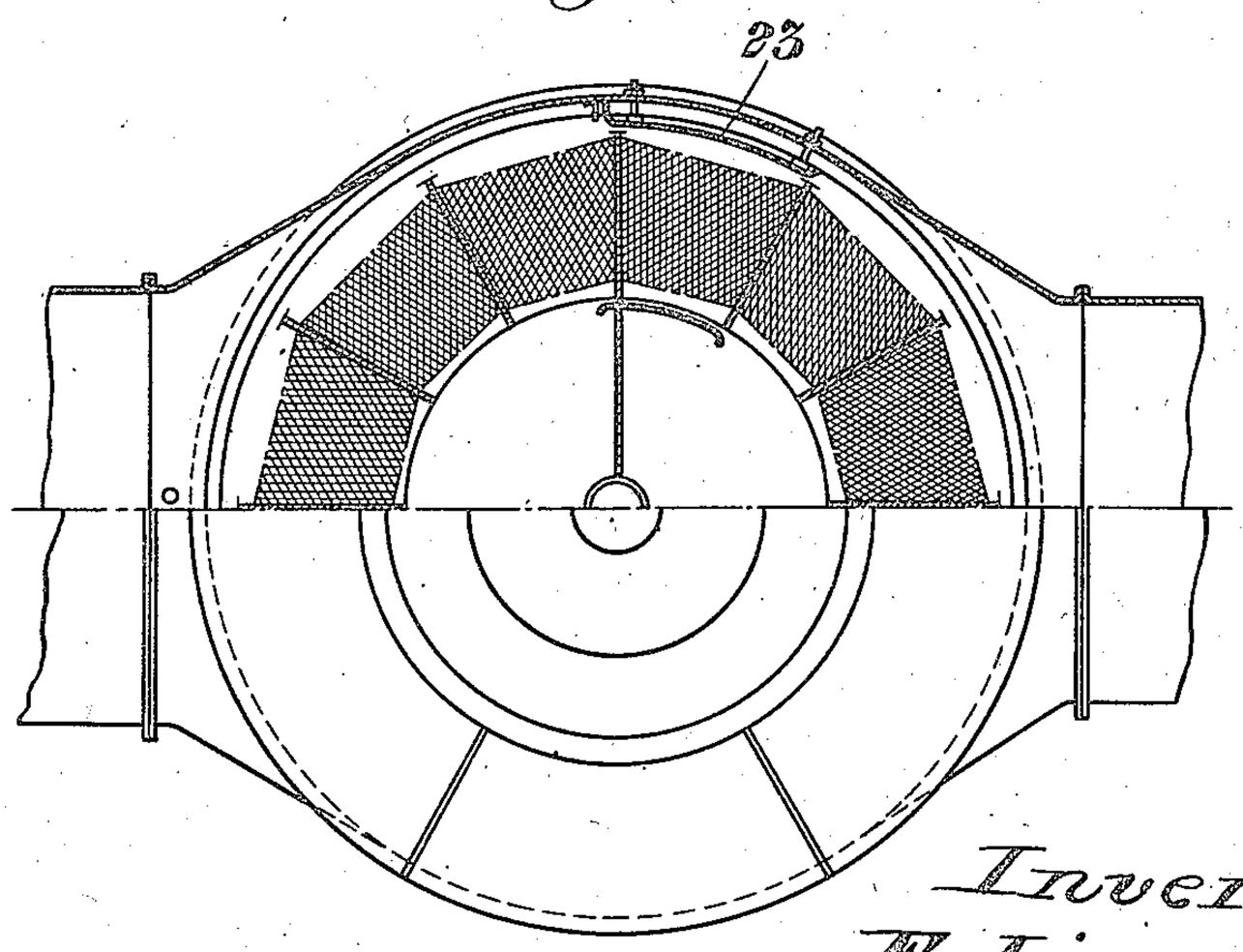


Fig. 5.



Inventors
F. Ljungström
N. F. F. Andersson
By Marks Clerk Attys

Patented Nov. 18, 1924. 1,516,108

UNITED STATES PATENT OFFICE.

FREDRIK LJUNGSTRÖM, OF LIDINGO-BREVIK, AND NILS FREDRIK FILEMON ANDERSSON, OF STOCKHOLM, SWEDEN, ASSIGNORS TO AKTIEBOLAGET LJUNGSTRÖMS ÅNGTURBIN, OF STOCKHOLM, SWEDEN, A CORPORATION.

REGENERATIVE AIR PREHEATER.

Application filed August 21, 1922. Serial No. 583,459.

To all whom it may concern:

Be it known that we, (1) FREDRIK LJUNGSTRÖM, a subject of the King of Sweden, residing at Lidingo-Brevik, Sweden, and (2) NILS FREDRIK FILEMON ANDERSSON, a subject of the King of Sweden, residing at 70 Riddaregatan, Stockholm, Sweden, have invented new and useful Improvements in Regenerative Air-Preheaters, of which the following is a specification.

In generative air-preheaters it has been previously proposed to make these of a regenerative mass carried by a continuously rotating rotor which is surrounded by a casing having fans arranged therein, which fans drive forth the air and the flue gases. In these constructions, the gases and the air are driven by the fans through the rotor in the axial direction, the fans being preferably mounted on a common shaft disposed axially outside the rotor and at right angles to the axis of the rotor.

On account of the arrangement of the fans and the shape of the casing, these constructions are very large and, therefore, unnecessarily spacious. If such a preheater is intended to be used as a preheater for the combustion air in a power house for steam operation, and is mounted in a branch pipe to the smoke stack, difficulties have always been encountered in providing the required space for the same.

The object of the present invention is to remove these drawbacks by providing a regenerative air-preheater which is of the continuously rotating type and requires a very small space, the invention consisting therein that the fans drive forth the different gases in a radial direction through the rotor, the same being preferably arranged in the axial extension of the rotor.

In the accompanying drawings, two embodiments of the invention are diagrammatically shown by way of example. Fig. 1 shows to the right an axial section and to the left an elevation of one embodiment of an air-preheater according to the invention. Fig. 2 shows in its upper portion a section at right angles to the rotor shaft and in its lower portion a plan view of this embodiment, whereas Fig. 3 shows an elevation thereof. Figs. 4, 5 and 6 represent views of a second embodiment corresponding to Figs. 1, 2 and 3 respectively.

In the embodiment shown in Figs. 1, 2 and 3, 1 designates the regenerative rotor. This regenerative material forms in the embodiment shown what might be termed a poly-faced ring body the imaginary inner surface of which may be considered as a wall with multitudinous passageways in it designated by reference character 2. The imaginary outer wall of this ring body is designated by the reference character 3. These walls 2 and 3 are formed by the ends of the members of the regenerative mass which preferably consists of metal plates so arranged as to afford a plurality of passageways allowing passage of the fluid substantially as indicated by the arrows. As an example of one form of material horizontally disposed corrugated plates placed with the corrugations oblique to each other may be used as diagrammatically indicated in Fig. 2 of the drawings. The walls 2 and 3 will have the appearance of a honeycomb structure, looking at the same in a radial direction. It is obvious that many forms of regenerative material may be used and the so-called poly-faced ring body may be of other and varied constructions. The rotor is attached to the shaft 4 through which extends the common shaft 6 of the fans 5 and 7. The fan shaft 4 is connected by means of a coupling 8 directly, or through the medium of a pulley, with a driving motor, not shown in the drawing. From the shaft of the fans, the motion is geared down through a planet gear 9 to the rotor shaft 4 which is thus driven from the same motor as the fans.

The air-preheater is connected in such a manner to the furnace in which it is to be used that the hot gases enter through the inlet opening 30 situated in the radial extension of the rotor 1, and pass in the direction of the arrows 10 and 11 through the regenerative rotor. The air to be preheated is sucked in by the fan 5 and is forced, as shown by the arrows 12 and 13, in a radial direction through the rotor 3, after which it escapes in a heated condition from the preheater through the outlet 14 to the place where it is to be used. Preferably, as shown in Fig. 2, by the arrows 10, 11, 12 and 13 the preheating of the air takes place according to the counter-flow principle, in that the hot flue gases pass from

the outside and inwardly through the rotor, while the air to be preheated passes from the inside and outwardly through the same rotor. In the embodiment shown, the fans are situated outside the rotor in the axial direction thereof, but they may also be conceived as being located in the inlet- or outlet passages on the outside of the rotor in the radial direction thereof, the latter arrangement being less suitable, however, because the fans will then be situated where the air and the gases are the hottest.

The rotor is covered on its upper and lower sides by cover plates 15 and 16 respectively, in which holes 17 and 18 respectively are provided for letting out the gases to the center of the rotor, whence they pass in and out through the regenerative mass. The said openings in the rotor plates correspond to the surfaces in Fig. 2 indicated with dot-and-dash lines.

The gases may also pass in a radical direction through the rotor which is opposed to the directions shown in the figure by the arrows, it is true, but the directions indicated are the most suitable, in that the areas of the passages through the regenerative mass are increased thereby, or decreased in the same degree as the gases are heated or cooled in passing through the rotor, which corresponds to the increase or the decrease of the gas volume. The air-preheater shown is provided in known manner with packing means and with means for mounting fans and the like with loose rings, and arrangements previously known from such air-preheaters, in which the gases flow through the rotor in an axial direction, such as sweeping devices 31, may also be provided in the present air-preheater, so far as the constructions allows it, 23 denotes a packing device preventing the flue gases from passing into the fresh-air channel, and vice versa. Partitions 22 divide the gases in a number of currents.

Figs. 4, 5 and 6 illustrate a second embodiment of an air-preheater according to the invention. In the same way as above described, the regenerative mass is arranged in a ring between the imaginary walls 2 and 3, whereby the rotor will be cylindrically hollow. The hollow in question, which constitutes a passage for the flue gases and the air to be preheated, is divided in two parts by means of an oblique non-rotating wall 20, the different gases passing respectively on either side of this wall. In this embodiment, the rotor is mounted on its shaft 4 by means of spokes 21. In this embodiment, the walls 22 shown in the preceding embodiment, together with the apertured cover plates 15 and 16, are replaced only by the oblique wall 20. Arranged in the manner above described are the packings, bearings and adjusting means for the fans, etc. Fig. 4 shows how the fans 5 and 7 are arranged inside the adjustable rings 25 and 26.

Preferably, air-preheaters of the regenerative type are always placed above the boiler in the proximity of the smoke stack or other outlets, their location, therefore, being often near the roof above the fireman's place. An air-preheater of the older type occupies a much larger space and is more difficult to dispose of adjacent the roof than a preheater in accordance with the invention. An axial extension of the air-preheater to nearly the double extent will evidently interfere with the space available underneath the same and, therefore, a preheater according to the invention is better adapted for being installed in boiler plants which, from the beginning, were not intended for such constructions.

What we claim as new and desire to secure by Letters Patent of the United States is:—

1. A regenerative preheater for air and the like in furnace plants or the like, comprising a regenerative material, a frame carrying said regenerative mass, inlet and outlet channels for the fluid giving off heat and for the fluid to be heated respectively, means for effecting a relative movement between said frame and said inlet and outlet channels, a casing surrounding the frame, and inlet and outlet openings in said casing so arranged as to permit the fluid giving off heat and the fluid to be heated to pass through the regenerative material in a radial direction of the frame.

2. A regenerative preheater for air and the like in furnace plants or the like, comprising a regenerative material, a frame carrying said regenerative mass, inlet and outlet channels for the fluid giving off heat and for the fluid to be heated respectively, means for effecting a relative movement between said frame and said inlet and outlet channels, a casing surrounding the frame, inlet and outlet openings in said casing and fans arranged in said casing, said inlet and outlet openings and said fans being so arranged as to permit the fluid giving off heat and the fluid to be heated to pass through the regenerative material in a radial direction of the frame.

3. A regenerative preheater for air and the like in furnace plants or the like comprising a regenerative material, a rotatably mounted rotor carrying said regenerative material, means for rotating the rotor partly in the fluid giving off heat and partly in the fluid to be heated, a casing surrounding the rotor, inlet and outlet openings in said casing and fans for moving the fluids through the rotor arranged in said casing, said fans operating in planes parallel to the plane of rotation of the rotor, said inlet and outlet openings and said fans being so ar-

ranged as to permit the fluid giving off heat and the fluid to be heated to pass through the regenerative material in a radial direction of the rotor.

4. A regenerative preheater for air and the like in furnace plants or the like comprising a regenerative material, a rotatably mounted rotor carrying said regenerative material, means for rotating the rotor partly in the fluid giving off heat and partly in the fluid to be heated, a casing surrounding the rotor, inlet and outlet openings in said casing and fans for moving the fluids through the rotor mounted in said casing on a common shaft which coincides with the axis of rotation of the motor, and operating in planes parallel to the plane of rotation of the rotor, said inlet and outlet openings and said fans being so arranged as to permit the fluid giving off heat and the fluid to be heated to pass through the regenerative material in a radial direction of the rotor.

5. A regenerative preheater for air and the like in furnace plants or the like comprising a regenerative material, a rotatably mounted rotor carrying said regenerative material, means for rotating the rotor partly in the fluid giving off heat and partly in the fluid to be heated, a casing surrounding the rotor, inlet and outlet openings in said casing and fans for moving the fluids through the rotor mounted on a common shaft, which passes through the shaft of the rotor, and operating in planes parallel to the plane of rotation of the rotor, said inlet and outlet openings and said fans being so arranged as to permit the fluid giving off heat and the fluid to be heated to pass through the regenerative material in a radial direction of the rotor.

6. A regenerative preheater for air and the like in furnace plants or the like, comprising a regenerative material, a frame carrying said regenerative mass, inlet and outlet channels for the fluid giving off heat and for the fluid to be heated respectively, means for effecting a relative movement between said frame and said inlet and outlet channels, a casing surrounding the frame, an inlet opening in said casing for one of the fluids arranged in a radial direction of the rotor, an outlet opening in said casing for the other fluid arranged likewise in a radial direction of the rotor and fans for moving the two fluids through the rotor, said fans being so arranged as to permit the fluid giving off heat and the fluid to be heated to pass through the regenerative material in a radial direction of the frame.

7. A regenerative preheater for air and the like in furnace plants or the like, comprising a regenerative material, a frame carrying said regenerative mass, inlet and outlet channels for the fluid giving off heat and for the fluid to be heated respectively, means for effecting a relative movement between said frame and said inlet and outlet channels, a casing surrounding the frame, an inlet opening in said casing for the one fluid arranged in a radial direction of the rotor, an outlet opening for the same fluid arranged in an axial direction of the rotor, an inlet opening for the other fluid arranged in an axial direction of the rotor, an outlet opening for the latter fluid arranged in a radial direction of the rotor, and fans for moving the two fluids through the rotor, said fans being so arranged as to permit the first-mentioned fluid to pass through the rotor from without and inwards and the last-mentioned fluid to pass through the rotor from within and outwards.

In witness whereof we have hereunto set our hands in the presence of two witnesses.

FREDRIK LJUNGSTRÖM.
NILS FREDRIK FILEMON ANDERSSON.

Witnesses:
L. BERG v. LINDE,
TORN FALK.